JPL

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High Contrast Imaging Testbed

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TPF Science, Technology, and Design Expo
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HCIT Objectives

- Laboratory validation of coronagraph technology
  - Wavefront Sensing and Control
    - Measure and correct amplitude and phase errors
  - Deformable mirror performance
  - Masks and Stops
  - End-to-end coronagraph performance
  - Modeling
  - Component characterization
  - Stray light suppression
- Demonstration of coronagraph flight readiness
  - Deterministic achievement of testbed goals
  - Test elements of TPF coronagraph error budget

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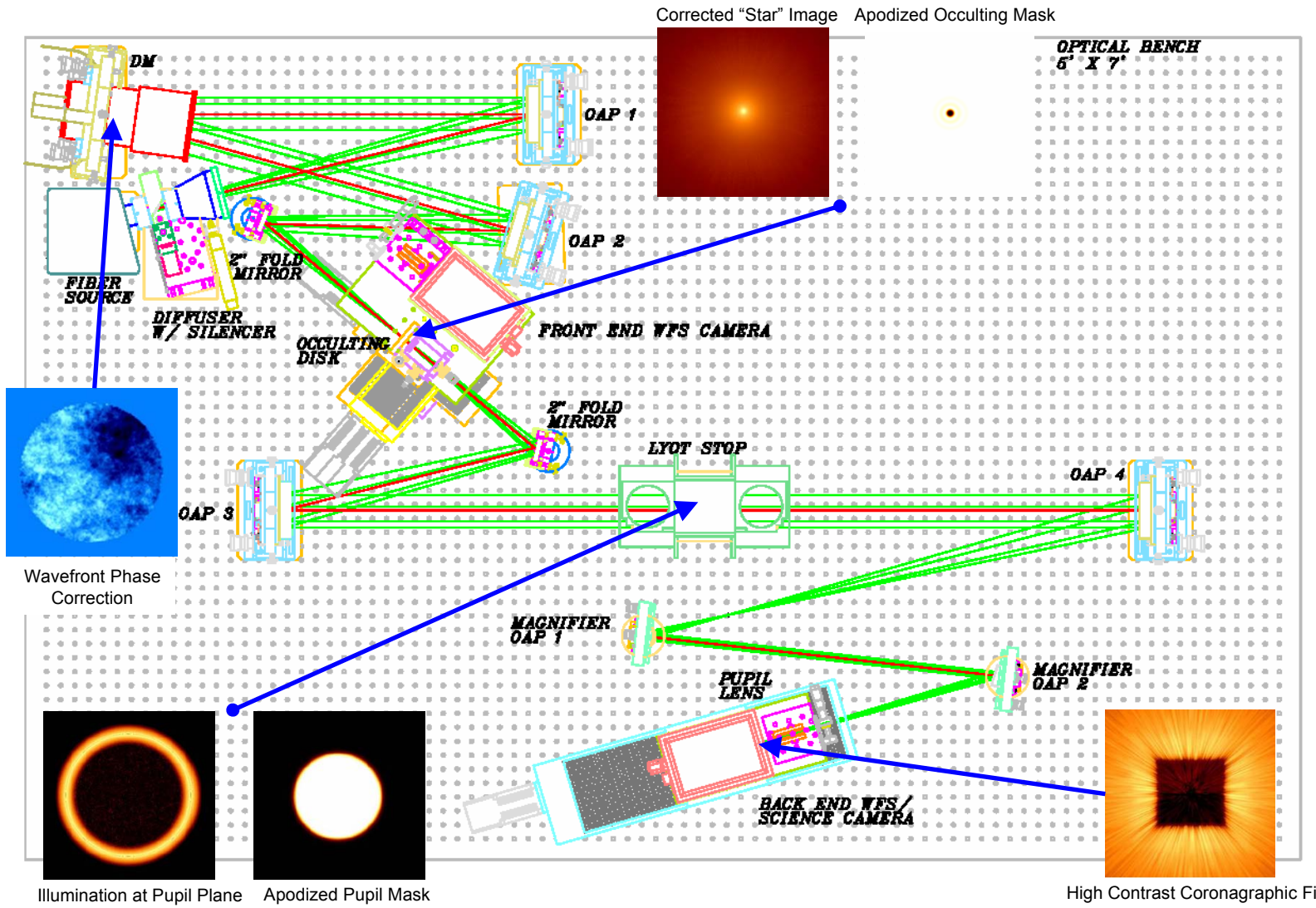
Current Testbed Layout



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Testbed in Vacuum

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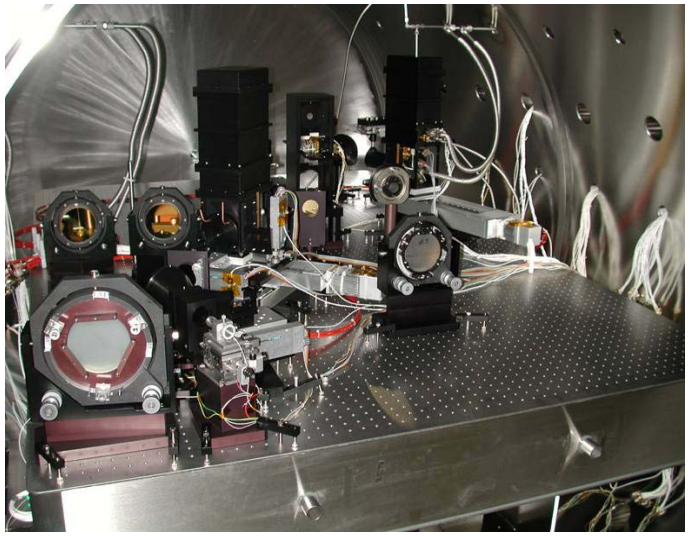
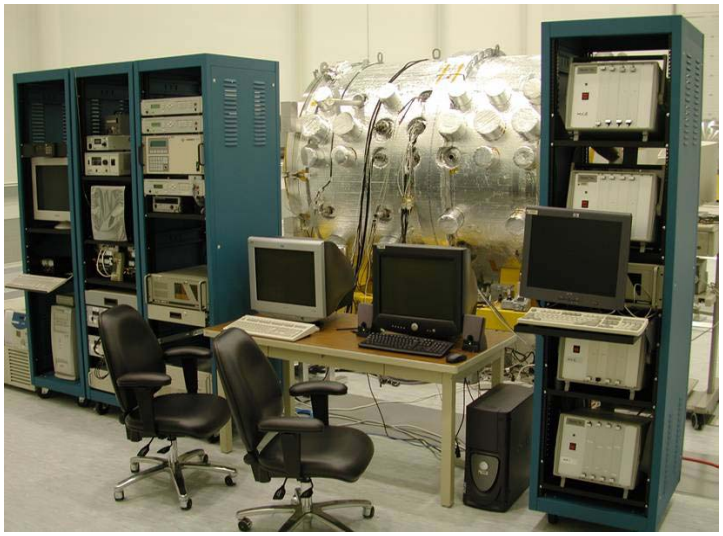
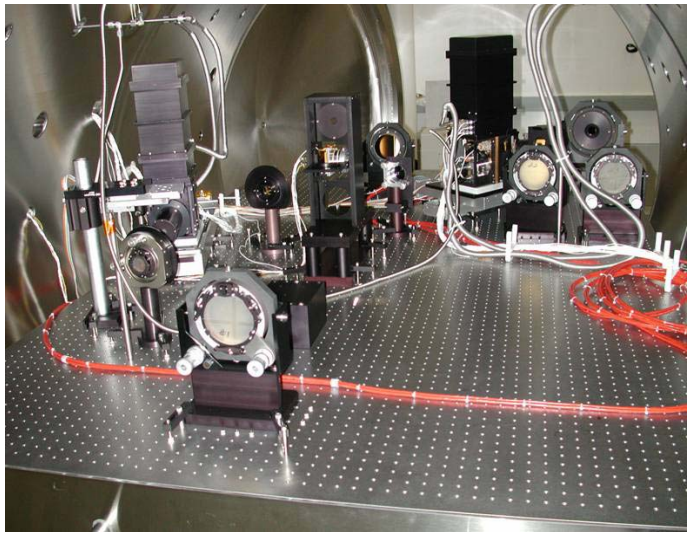
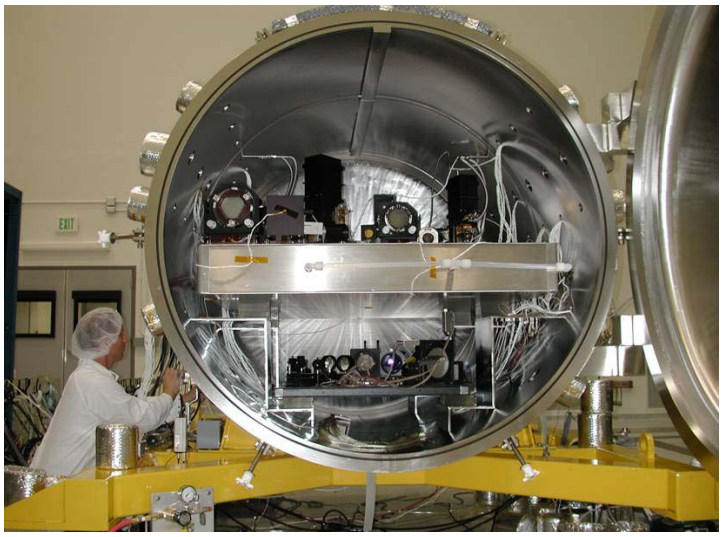
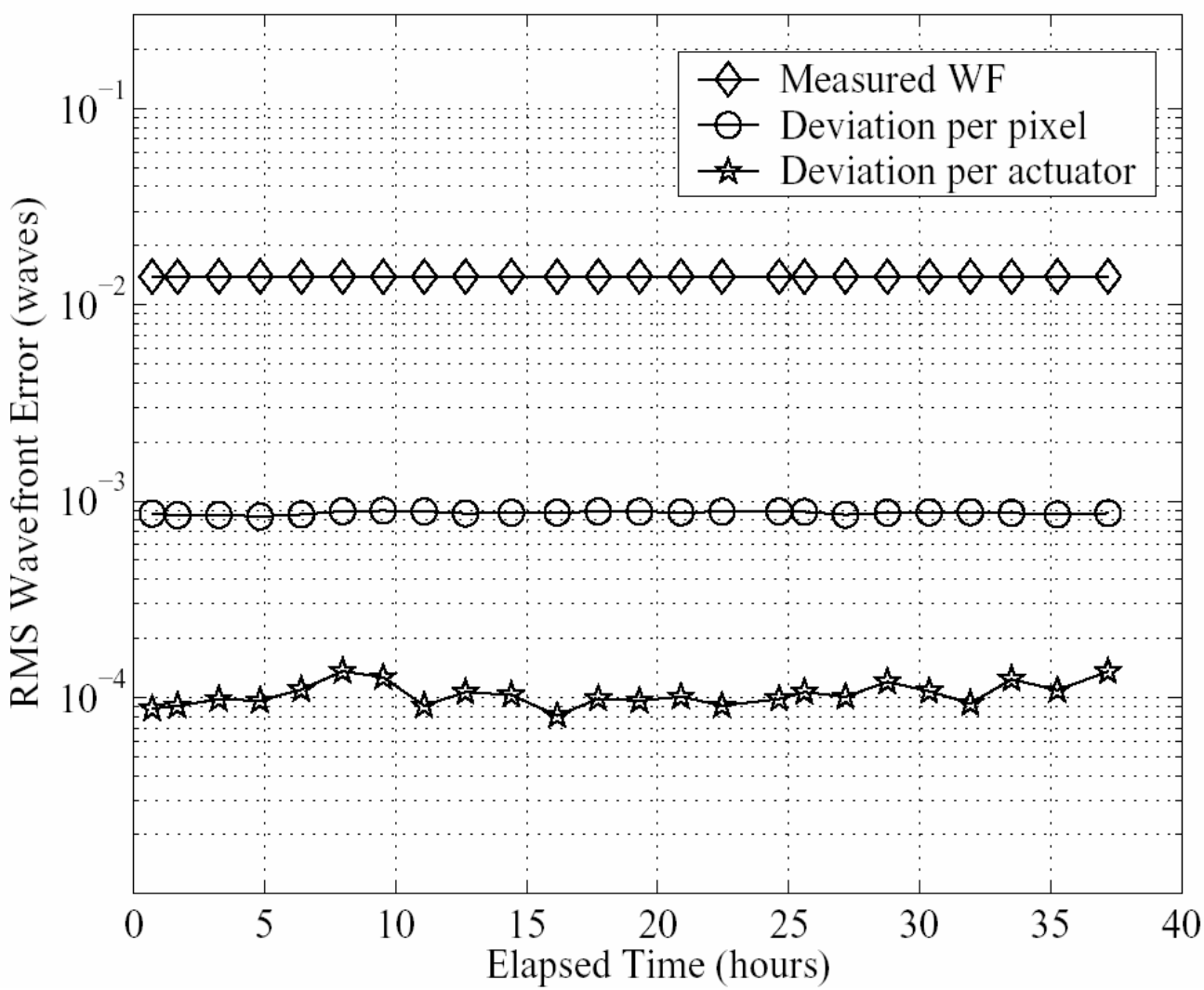








Baseline WFS (MGS) Repeatability



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Baseline WFS (MGS) Repeatability II

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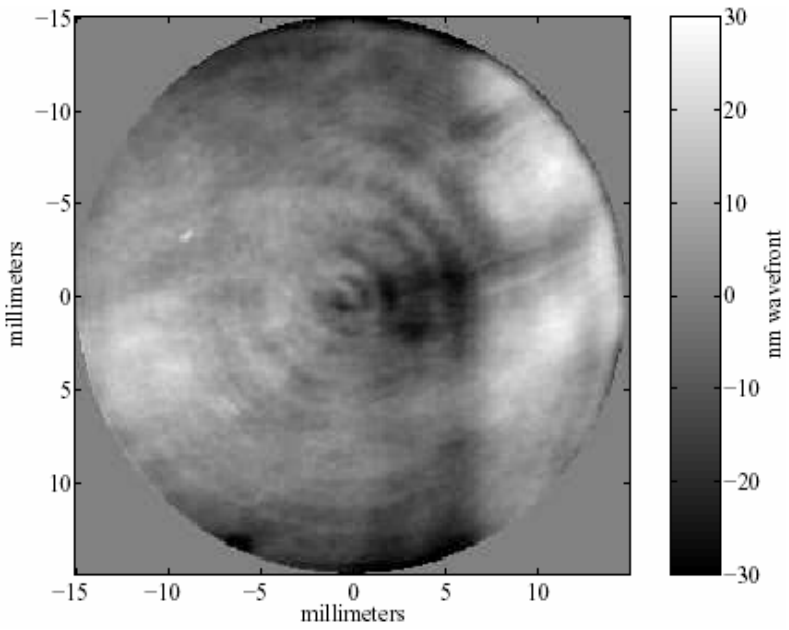
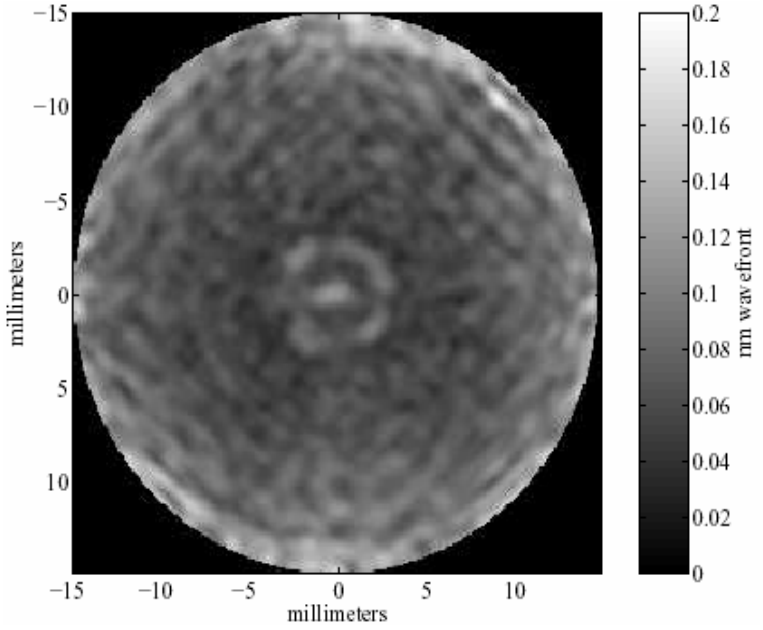
Average Estimate



Standard Deviation within 15 Cycles/Pupil



Baseline WFS Model Match

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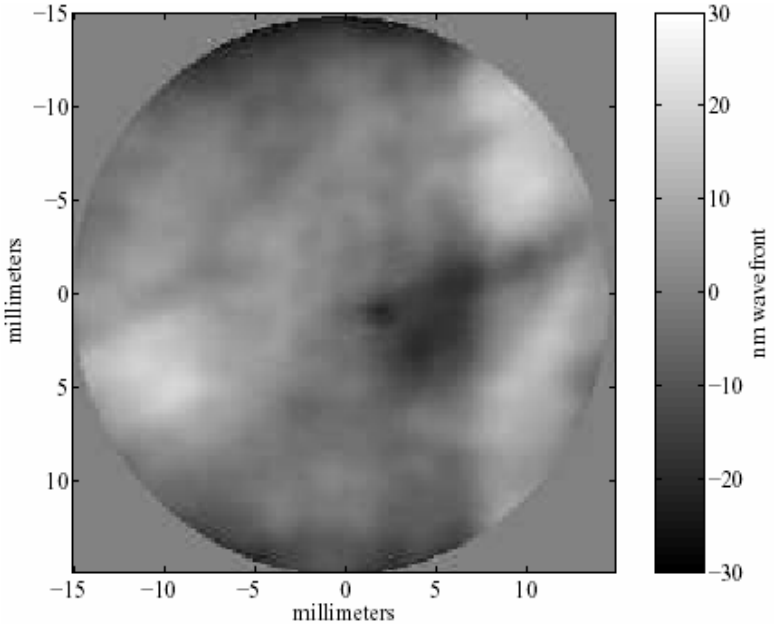
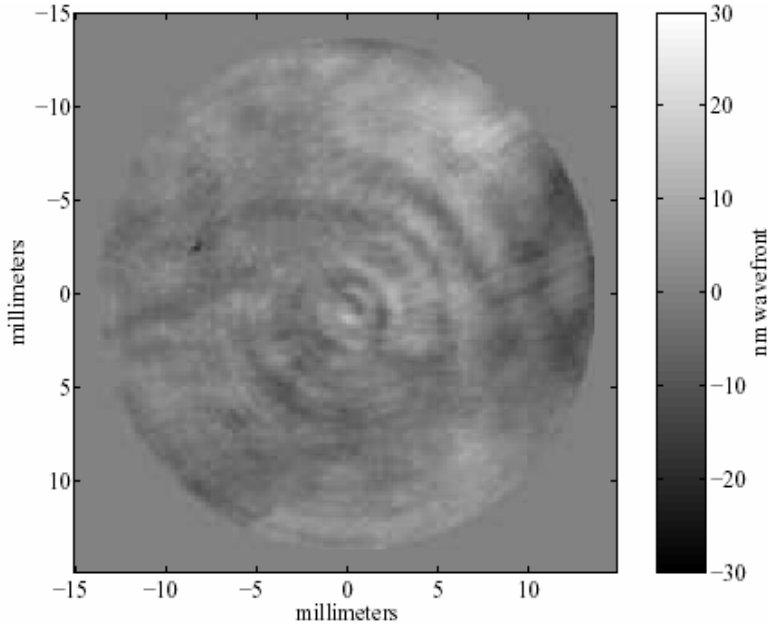
OPD From Diffraction Model

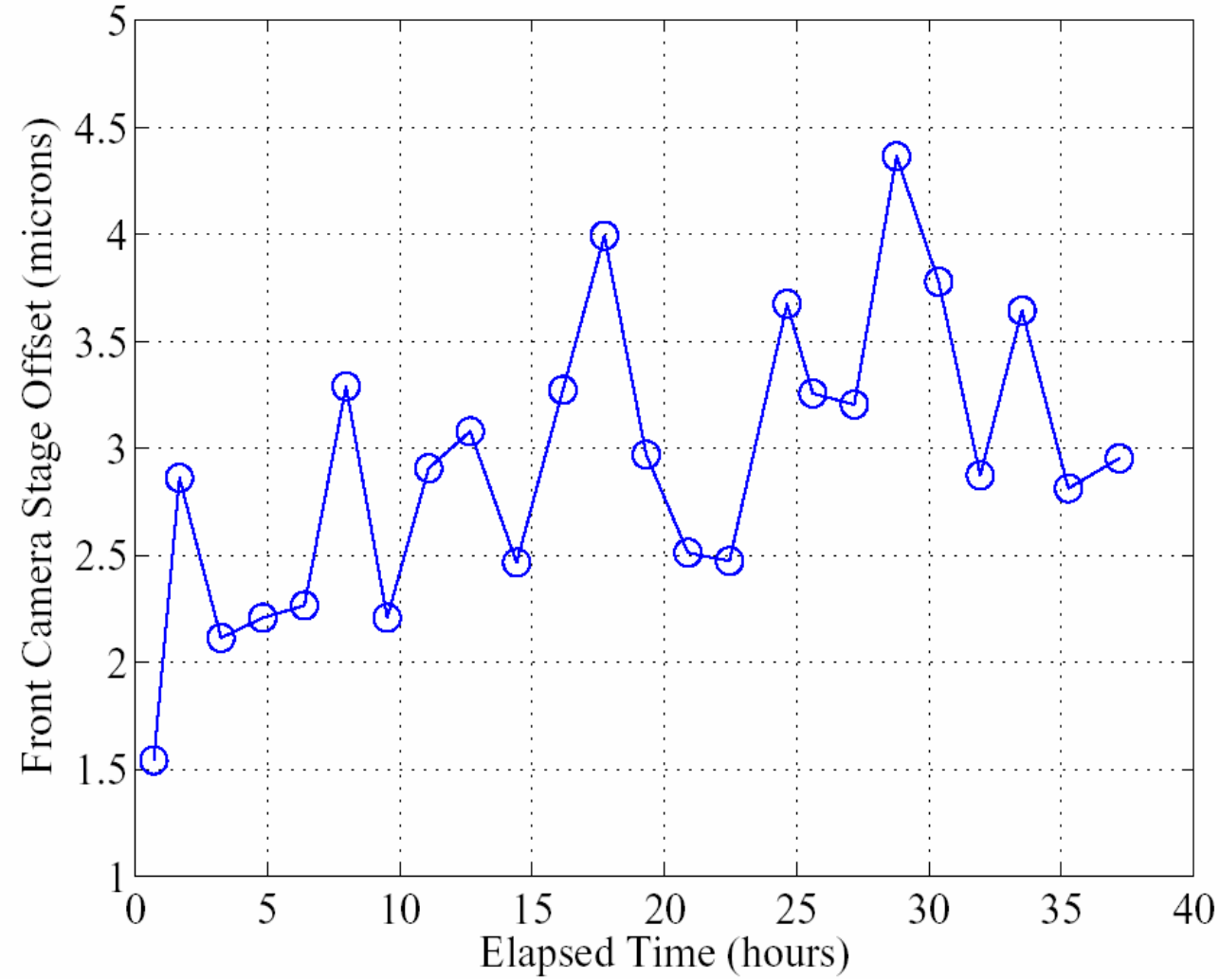


Difference from Diffraction Model



λ/200 rms agreement…enviable for traditional telescope, not for TPF

Drift in Camera Focus



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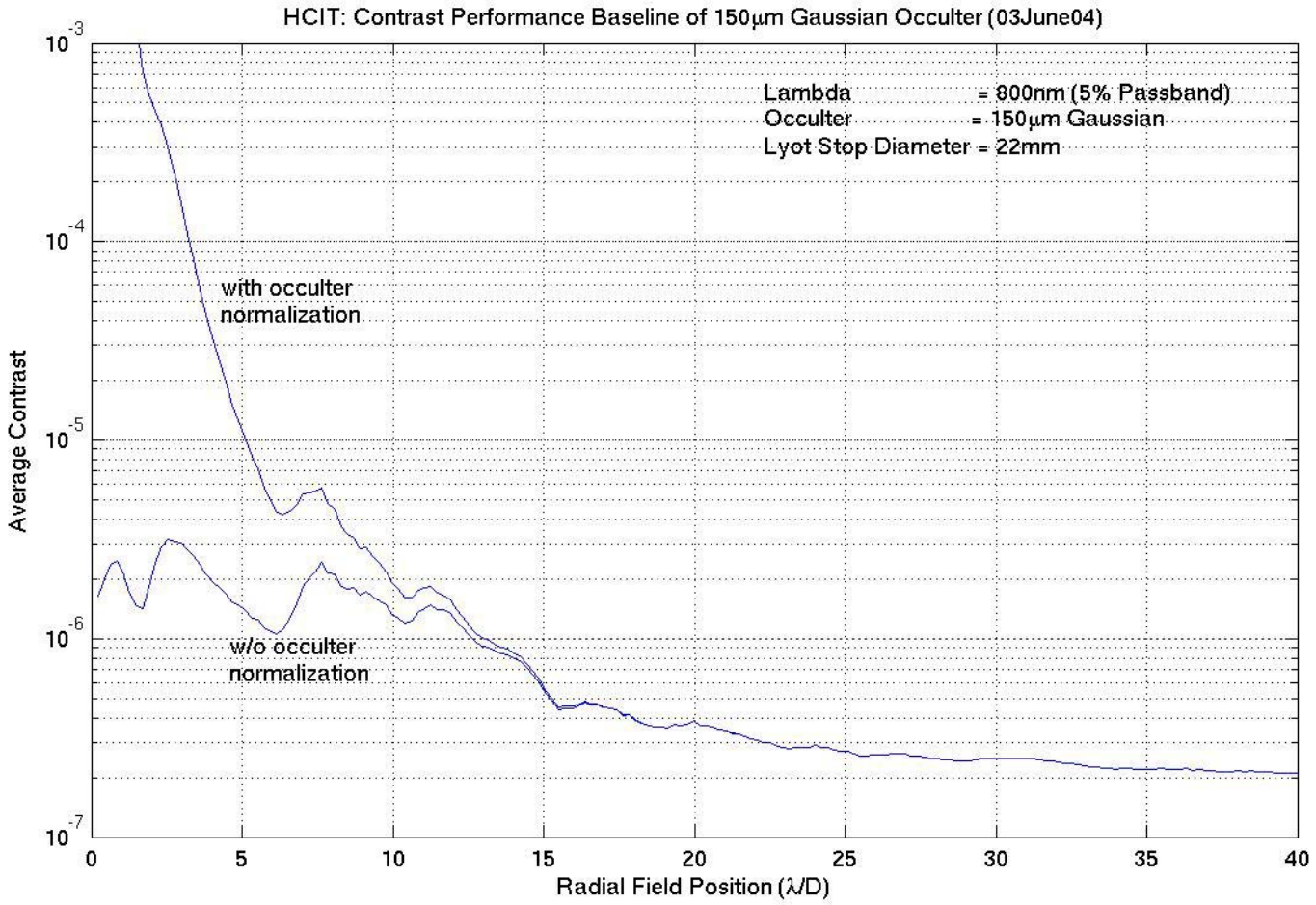
Baseline Performance (Flat) in Vacuum



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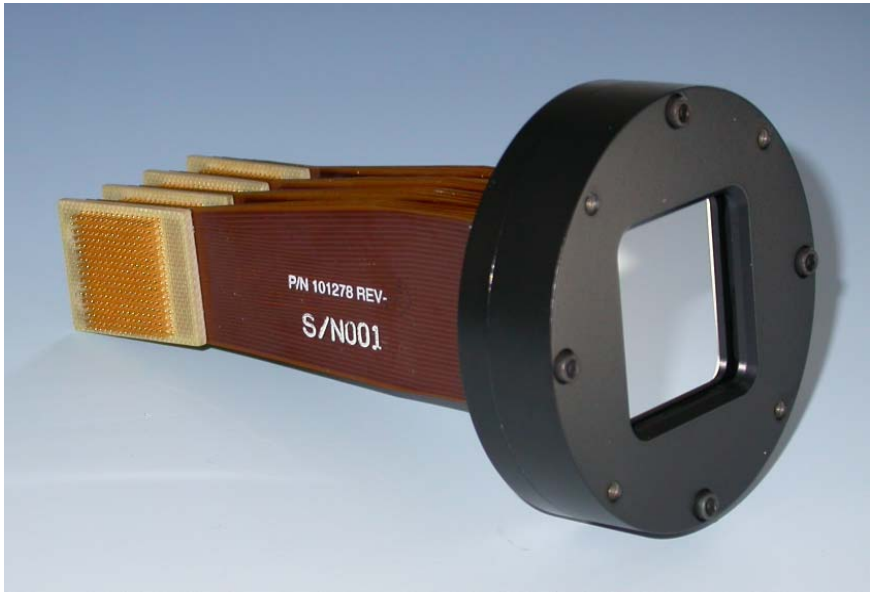
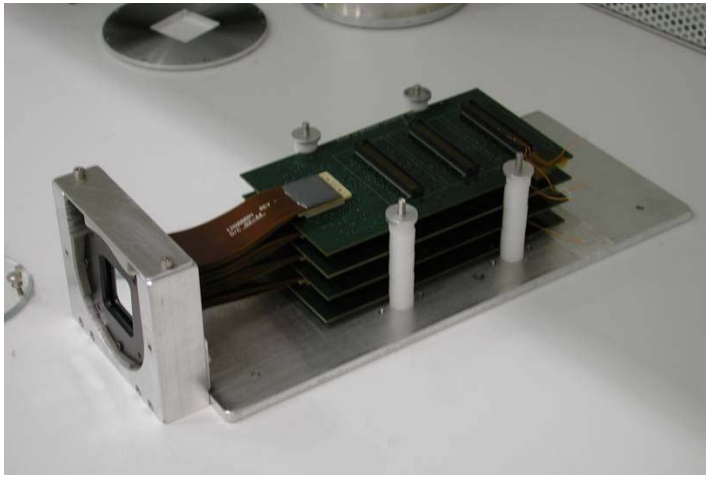
32x32 Deformable Mirror "Gen 2"





- Received two DM's from Xinetics
- Fully functional
- Actuation limited at edges
  - Reduced aperture 10%

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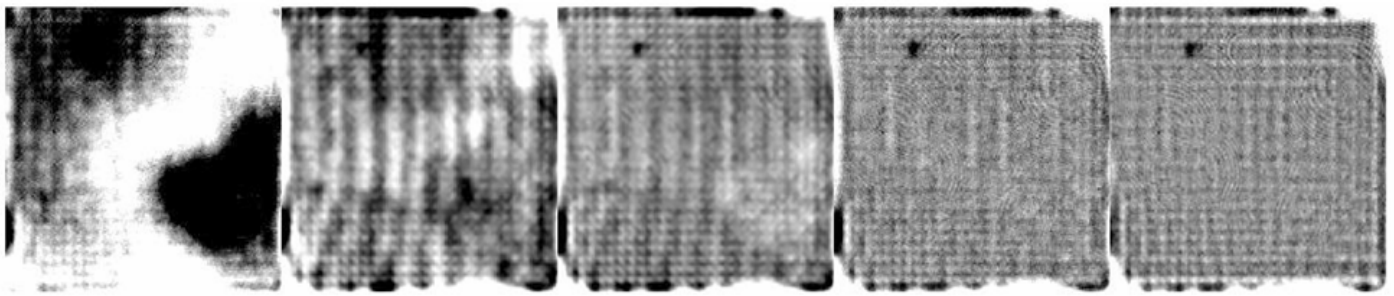
32x32 DM Performance

- Optical characterization in surface gauge
  - Michelson interferometer in vacuum, located beneath HCIT bench
- Sparse patterns applied to measure gains
- Wavefront flattened iteratively
  - Final surface figure (in controllable band) 1.5Å rms over 25x25 area
- DM integrated into HCIT



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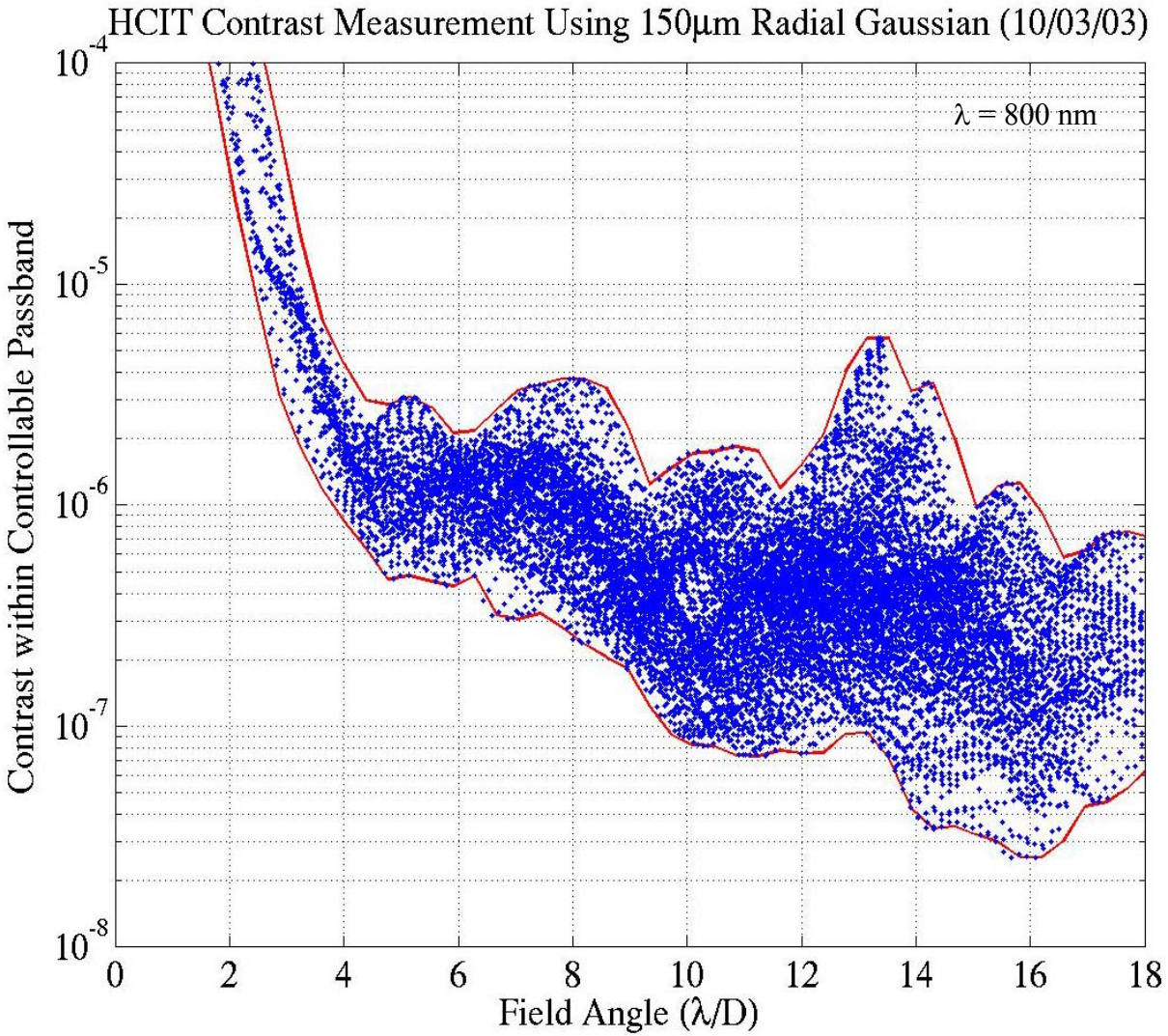
Contrast Measurement



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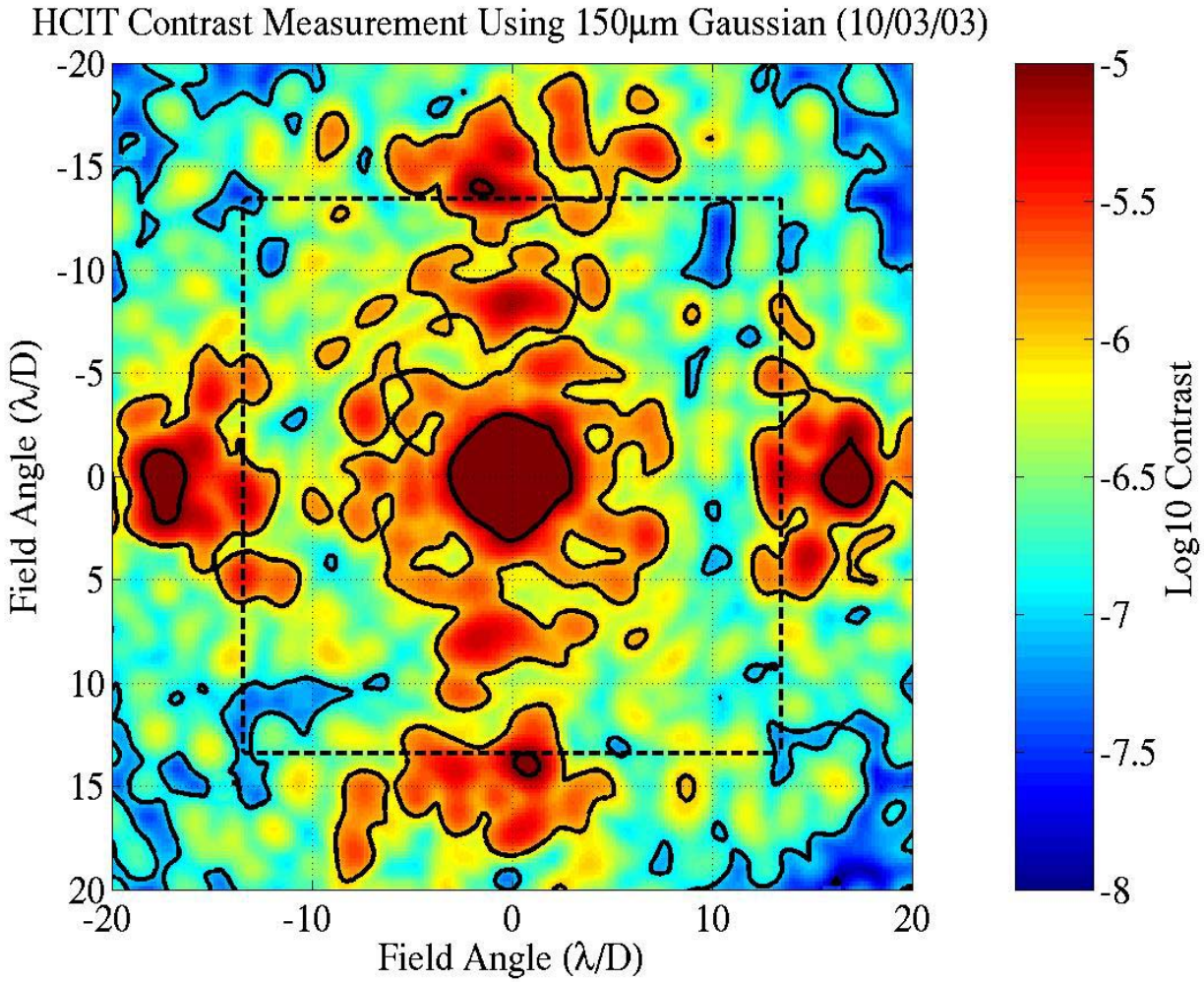
Contrast Contour Plot



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DM/MUX Development Status

- 64x64 DM development at Xinetics
  - DM currently in coating
  - Delivery expected 10/30

- MUX development
  - Needed to drive 64x64 DM
  - JPL-designed 64 channel low power, high voltage ASIC
  - Currently fabricating boards, testing packaged chips

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Component Characterization

- Component performance critical to testbed success
  - DM
  - Optical figure
  - Coatings
  - Fiber
    - How to make a star without artifacts
  - Masks and Stops
    - Both amplitude and phase impact performance
    - TPF is developing lab instrumentation to measure both

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Guest Testing on HCIT

- Masks and Stops
  - Both Lyot and apodized coronagraph concepts
- Modeling
- Telescope Front End
  - Hardware simulation of relevant TPF telescope
  - Star field and planet simulator
- Possibilities:
  - Nuller
  - Other hardware

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Acknowledgment

This research was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

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